What is claimed is:

1. A method of making an optical fiber preform assembly comprising: forming a plasma inside a tube, thereby forming a plasma zone; and introducing a flow of at least one precursor suitable for forming glass into the plasma zone, wherein said flow comprises eddy diffusion of the flow of the precursor.

2. A method of making an optical fiber preform assembly comprising: forming a plasma zone inside a tube, thereby forming a plasma zone; introducing a flow of at least one precursor suitable for forming glass into the plasma zone; and creating eddy diffusion flow in the plasma zone.

3. The method according to claim 2 wherein said creating eddy diffusion comprises inserting an eddy element inside said tube.

4. The method according to claim 3 further comprising aligning said element along an axial centerline of said tube, thereby preventing said precursor from flowing along a center axis of the tube from a first end of the tube to a second end of the tube.

5. The method according to claim 3 wherein a length of said eddy element comprises substantially the same length as the useable length of said tube.

6. The method according to claim 2 wherein said creating eddy diffusion comprises pulsing an energy source to form said plasma.

7. The method according to claim 6 wherein said energy source comprises a microwave energy source.

8. The method according to claim 2 wherein said creating comprises imparting a spiral spin into the plasma.

9. The method according to claim 2 further comprising depositing glass on an inner surface of said tube at a rate of greater than about 1.5 grams/minute.

10. The method according to claim 9 wherein said deposition rate comprises at least about 2.5 grams/ per minute.

11. The method according to claim 9 wherein said depositing comprises depositing matter substantially free of soot particles.

12. The method according to claim 9 further comprising ceasing said depositing prior to an inner radius of said tube being less than about 10% of an inner radius of said tube prior to said depositing.

13. The method according to claim 2 wherein said creating comprises forming a gradient in the concentration in the plasma zone in the axial direction of said tube.

14. The method according to claim 2 further comprising churning said precursor.

15. A microwave applicator for forming a plasma for a chemical vapor deposition process comprising:
a housing and a surface adjacent an outer surface of a substrate, wherein said surface comprises at least one portion protruding toward said outer surface of the substrate.

16. The microwave applicator according to claim 15 wherein said portion comprises at least one helical rib that extends along at least a segment of said surface of the applicator.

17. The microwave applicator according to claim 15 wherein said segment comprises at least a majority of said surface.

18. The microwave applicator according to claim 15 wherein said portion comprises a plurality of baffles staggered along at least a segment of said surface.

19. The microwave applicator according to claim 15 wherein said portion comprises a plurality of baffles aligned along at least a segment of said surface.

20. The microwave applicator according to claim 15 wherein said portion comprises a conductive heating element.

21. The microwave applicator according to claim 15 wherein said portion comprises an element capable of forming a thermal gradient along the outer surface of the substrate.

22. The microwave applicator according to claim 15 wherein said portion can be physically oscillated within the applicator.

23. A method of depositing glass on a substrate comprising:
flowing at least one glass precursor material at a predetermined mass flow rate into a substrate, wherein the predetermined mass flow rate comprises a rate at which the pressure within the substrate comprises no more than about 99% of the soot formation pressure;
reacting the glass precursor inside the substrate; and
subsequently modulating the mass flow rate to maintain the pressure within the substrate substantially constant.

24. The method according to claim 23 wherein the pressure within the substrate comprises no more than about 95% of the soot formation pressure.

25. The method according to claim 23 wherein the pressure within the substrate comprises no more than about 90% of the soot formation pressure.

26. The method according to claim 23 wherein the pressure within the substrate comprises no more than about 85% of the soot formation pressure.

27. The method according to claim 23 wherein said modulating comprises reducing the mass flow rate of said glass precursor material.

28. The method according to claim 23 wherein said glass precursor material comprises a silicon containing compound.

29. The method according to claim 23 wherein said reacting comprises forming a plasma inside said substrate.

30. The method according to claim 29 further comprising maintaining an intensity of said plasma substantially constant during said reacting.

31. The method according to claim 23 wherein said modulating comprises a stepwise modulation of said mass flow rate.

32. The method according to claim 23 wherein said modulating comprises a continuous modulation of said mass flow rate.

33. The method according to claim 23 further comprising depositing glass on an inner surface of said substrate, wherein an initial deposition rate of glass comprises at least about 2.2 grams/ minute.

34. The method according to claim 33 wherein an initial deposition rate during said depositing comprises

$$m_i = R_I^4(P_{SF}^2 - P_T^2)/ (C_1T\mu_{eff}(1+x))$$

wherein m_i comprises an initial deposition rate, R_I comprises initial internal radius of the substrate, P_{SF} comprises the soot formation pressure, P_T comprises the tailstock end pressure, C_1 comprises a constant, T comprises temperature, μ_{eff} comprises effective viscosity at temperature T, and x comprises the ratio of O_2 to a silicon containing precursor material.

35. The method according to claim 34 wherein a pressure in the deposition zone (P_D) comprises

$$P_D = (P_T^2 (R_I^2 - C_2m_it)^2 + C_1T\mu_{eff}(1+x)\, m_i)^{1/2} / (R_I^2 - C_2m_it)$$

wherein C_2 comprises a constant and t comprises time.

36. The method according to claim 34 wherein an instantaneous deposition rate comprises $(P_{SF}^2 - P_T^2)(R_I^2 - C_2mt) - C_1T\mu_{eff}\,(1=x)m = 0$, wherein C_2 comprises a constant and t comprises time.

37. A method of depositing glass on a substrate comprising:

depositing glass on an internal surface of a substrate having first and second ends; and

inserting a rod inside said second end of the of the substrate, wherein a length of said rod inside said substrate comprises less than the length of said substrate.

38. The method according to claim 37 wherein an external diameter of said rod comprises at least 25% of an internal diameter of said substrate.

39. The method according to claim 38 wherein said external diameter of said rod comprises no more than about 75% of said internal diameter of said substrate.

40. The method according to claim 37 wherein a decay length of material deposited along the internal surface of said substrate comprises L_I wherein

$$L_1 = L_0 \left((1-\kappa)/(1+\kappa)\right)$$

L_0 comprises the decay length in the substrate tube without the rod inserted in the tube and κ comprises a constant regarding the difference in an external diameter of the rod and an internal diameter of the substrate.

41. The method according to claim 37 further comprising aligning an external diameter of the rod substantially concentrically to an internal diameter of the substrate.

42. The method according to claim 37 wherein a said length of said rod comprises less than about 50% of said length of said substrate.

43. A method of making an optical fiber preform assembly comprising:

inserting an eddy current element into a substrate;

forming a plasma zone inside a tube, thereby forming a plasma zone; and

introducing a flow of at least one precursor suitable for forming glass into the plasma zone.